Department of Education and Communities

Traffic and Transport Assessment

Fairvale High School

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Job number 254846-00

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Contents

1 Introduction

JDH Architects, on the behalf of the NSW Department of Education has commissioned Arup to develop a Traffic and Transport Assessment for the proposed Fairvale High School expansion.

Fairvale High School has a current enrolment of 1,360 students. The expansion proposes to build new classrooms within the school campus, which could allow for an additional 200 students. This project aims to meet 27.55% of the projected student population growth within the Fairfield Secondary Cluster for the next 15 years.

This report assesses the impact the expansion (the proposal) would have on the surrounding road network.

1.1 Study area

Fairvale High School (the school) is located approximately 2.5 km north-west of Canley Vale Train Station and 3 km west of Fairfield Train Station.

The site is located adjacent to Thorney Road and forms the primary street frontage, vehicular and pedestrian access for the school. To the north of the site, Zarlee Street and Tripoli Road meet the site boundary. Zarlee Road connects to the site carpark, which continues through to Tripli Road, adjacent Avery Park. This connection is closed outside of school hours. Tripoli Road provides access for waste management vehicles.

The primary pedestrian access is located on Thorney Road. Vehicular entry is via. Tripoli Road, and staff entry via Zarlee Street.

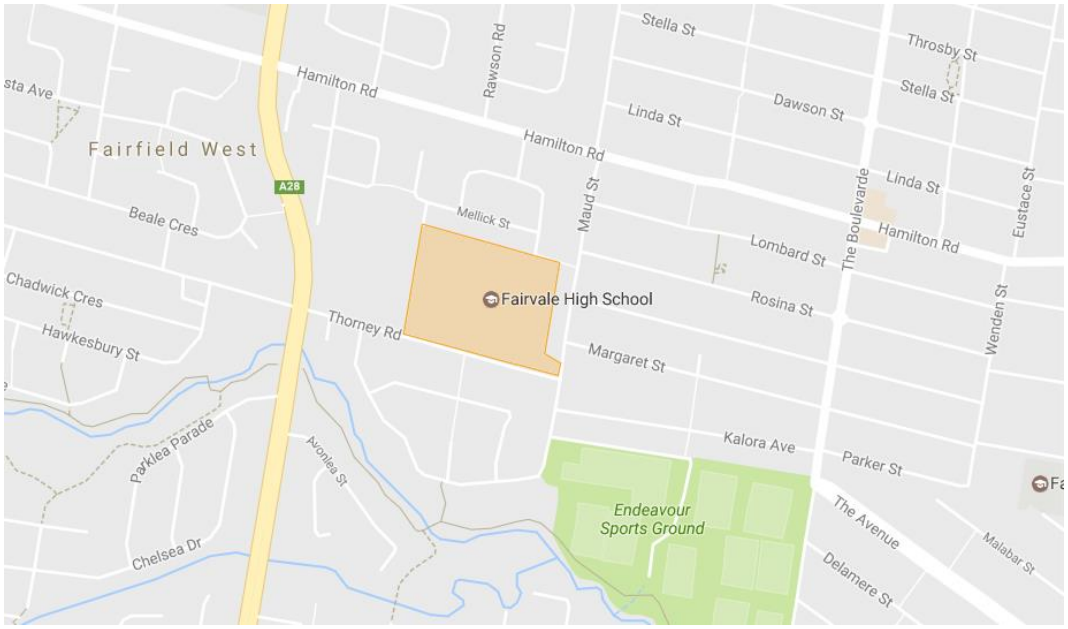


Figure 1: Fairvale High School site location

1.2 DPE Secretary's Environmental Assessment Requirements

The Department of Planning and Environment issued the Secretary's Environmental Assessment Requirements for the redevelopment of Fairvale High School. The proposal qualified as State Significant Development.

The following details in Table 1 respond to the requirements raised in the SEARs report.

Table 1: Secretary's Environmental Assessment Requirements and response

SEARs requirements	Addressed
Include a transport and accessibility impact assessment, which details, but not limited to the following:	-
accurate details of the current daily and peak hour vehicle, public transport, pedestrian and cycle movement and existing traffic and transport facilities provided on the road network located adjacent to the proposed development;	Discussed in section 2.7
an assessment of the operation of existing and future transport networks including the bus network and their ability to accommodate the forecast number of trips to and from the development;	Discussed in section 2.3.1 and 2.3.2
details of estimated total daily and peak hour trips generated by the proposal, including vehicle, public transport, pedestrian and bicycle trips based on surveys of the existing and similar schools within the local area;	Discussed in section 2.7 and 4.1
the adequacy of public transport, pedestrian and bicycle networks and infrastructure to meet the likely future demand of the proposed development;	Discussed in section 2.3 and 2.4
the impact of the proposed development on existing and future public transport infrastructure within the vicinity of the site in consultation with Roads and Maritime Services and Transport for NSW and identify measures to integrate the development with the transport network;	Discussed in section 4.3
details of any upgrading or road improvement works required to accommodate the proposed development;	Discussed in section 4.2
details of travel demand management measures to minimise the impact on general traffic and bus operations and to encourage sustainable travel choices and details programs for implementation, including the preparation of a location specific Sustainable/Green Travel Plan;	Discussed in section 5
the impact of trips generated by the development on nearby intersections, with	Discussed in section 4.2

SEARs requirements	Addressed
consideration of the cumulative impacts from other approved developments in the vicinity, and the need/associated funding for upgrading or road improvement works, if required. Traffic modelling is to be undertaken using, but not limited to, SIDRA network modelling for current and future years of the following, but not limited to, intersections: New Cambridge Street (Cumberland Highway)/Thorney Road;	
the proposed active transport access arrangements and connections to public transport services;	Discussed in section 5
details of any proposed school bus routes along bus capable roads (i.e. travel lanes of 3.5 m minimum) and infrastructure (bus stops, bus layovers etc.);	No additional buses required. Discussed in section 2.3.3
the proposed access arrangements, including car and bus pick- up/drop-off facilities, and measures to mitigate any associated traffic impacts and impacts on public transport, pedestrian and bicycle networks, including pedestrian crossings and refuges and speed control devices and zones;	No additional changes required. Discussed in section 2.6
measures to maintain road and personal safety in line with CPTED principles;	No additional changes required. Discussed in section 2.6
proposed bicycle parking provision, including end of trip facilities, in secure, convenient, accessible areas close to main entries incorporating lighting and passive surveillance;	Discussed in section 3.1
proposed number of on-site car parking spaces and corresponding compliance with existing parking codes and justification for the level of car parking provided on-site;	Discussed in section 4.6
details of emergency vehicle access arrangements;	Discussed in section 3.2
an assessment of road and pedestrian safety adjacent to the proposed development and the details of required road safety measures;	The proposal does not include any changes to external road infrastructure
service vehicle access, delivery and loading arrangements and estimated service vehicle movements (including vehicle type and the likely arrival and departure times);	Discussed in section 3.2
in relation to construction traffic: assessment of cumulative impacts associated with other construction activities (if any); an assessment of road safety at key intersection and locations subject to heavy vehicle construction traffic movements and high pedestrian activity; details of construction program detailing the anticipated construction duration and	Please refer to the proposal's Construction Traffic Management Plan.

SEARs requirements	Addressed
highlighting significant and milestone stages and events during the construction process; details of anticipated peak hour and daily construction vehicle movements to and from the site; details of access arrangements of construction vehicles, construction workers to and from the site, emergency vehicles and service vehicle; details of temporary cycling and pedestrian access during construction; details of proposed construction vehicle access arrangements at all stages of construction; and traffic and transport impacts during construction, including cumulative impacts associated with other construction activities, and how these impacts will be mitigated for any associated traffic, pedestrian, cyclists, parking and public transport, including the preparation of a draft Construction Traffic Management Plan to demonstrate the proposed management of the impact.	
Guide to Traffic Generating Developments (Roads and Maritime Services) EIS Guidelines – Road and Related Facilities (DoPI) Cycling Aspects of Austroads Guides NSW Planning Guidelines for Walking and Cycling Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development Standards Australia AS2890.3 (Bicycle Parking Facilities)	Used in the report.

1.3 Consultation

The consultant team attended a consultation meeting with TfNSW and Roads and Maritime Services (RMS) to discuss traffic and transport aspects of the proposal on 9 November 2017.

An outline of the proposal was provided and discussion occurred regarding the transport requirements for access to the school. A number of key issues to address in the assessment were identified as road safety, construction activity interaction with the school, include details on the operation of the Thorney Road intersection with Cumberland Highway and sustainable travel initiatives for staff and students.

2 Existing Conditions

This section examines the existing conditions in terms of transport infrastructure around the site.

2.1 Road classifications

All roads immediately adjacent to the school, including Thorney Road, are non-classified roads. The classified road around the site is illustrated in Figure 2. Key classified roads which provide access to the site are:

- Cumberland Highway (State Road)
- Hamilton Road (Regional Road)

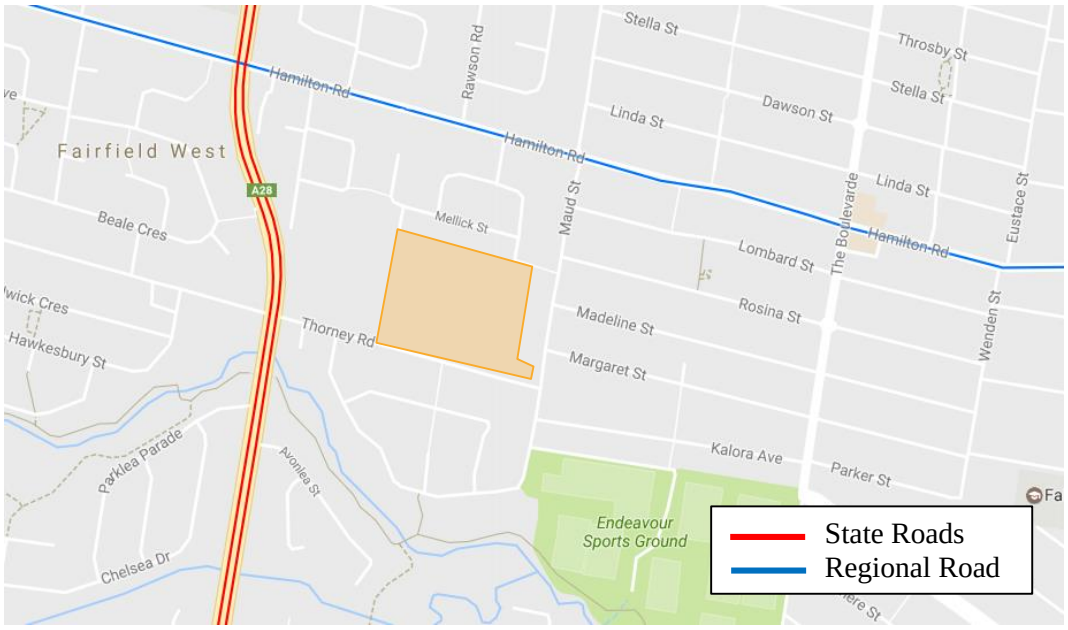


Figure 2: Classified Roads around the site

The Cumberland Highway provides a major north-south connection between Wentworthville to the north and Liverpool to the south. The road is three lanes in each direction at the intersection with Thorney Road, with a posted speed limit of 70 km/hr.

Hamilton Road provides a regional east-west movement, approximately 400 metres north of the site. The road provides linkages to Wakeley to the west and Fairfield to the east. The road is generally 2 lanes of traffic in each direction, with kerbside lane allocated to parking through residential sections, and is sign posted 50 km/hr excluding school zone areas.

2.2 Traffic survey counts

Arup has commissioned traffic survey counts on 24 March 2017 at key intersections:

- Cumberland Highway / Thorney Road
- Maud Street / Thorney Road

Counts were carried out at the following peak hours:

- 8:00am to 9:00am
- 2:30pm to 3:30pm

The data will be used to understand the existing and future performance of the key intersections, with details in section 4.2.2.

2.3 Public transport

Due to the permeability of the street and road network, it is difficult to trace and follow the direction that students come from using public transport (other than by private vehicle). Therefore, a breakdown of each public transport mode is not provided.

2.3.1 Buses

Several bus stops are located around the school (Figure 3) which provide services to Liverpool and Parramatta. The 802 bus route services Thorney Road and operates all days, while the 804 bus route is diverted from Hamilton Road and provides limited services during school days only.

The Parramatta to Liverpool routes have the following frequencies during the school peak hours:

- Bus 804, four buses between 7:45am to 8:45am, two buses between 3:00pm to 4:00pm
- Bus 802, two buses between 7:45am to 8:45am, three buses between 3:00pm to 4:00pm

Arup conducted site visits on 12 October 2017 at the bus stops shown in Figure 3, during school peak periods. All the buses were observed to have no more than approximately 70% of the seat occupied, with no passengers standing. This indicates spare occupancy within both public bus routes that may accommodate increases in student numbers.

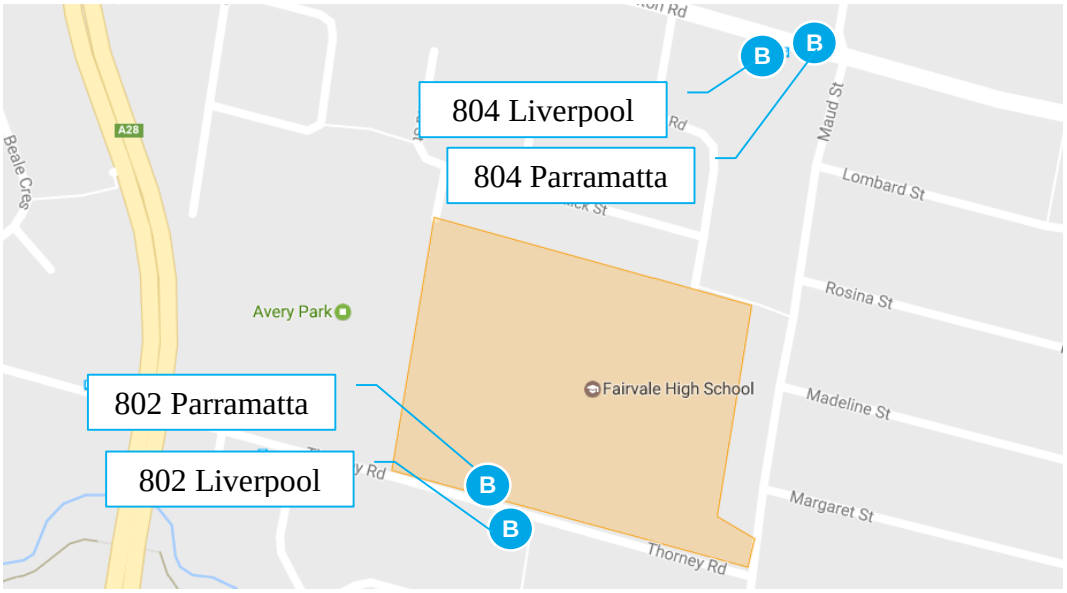
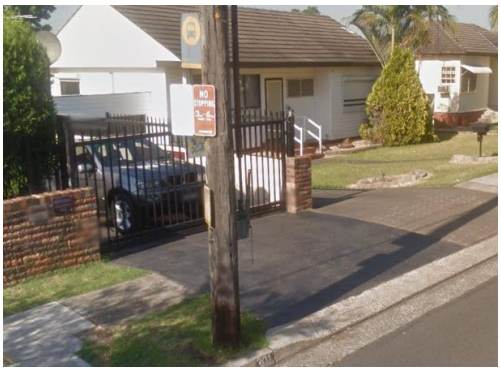


Figure 3: Bus stops located around the school

Photograph 1: Bus stop outside the school on Thorney Road



Photograph 2: Bus stop along Hamilton Road

2.3.2 Trains

The nearest train stations to the school are:

- Fairfield Station, 3km from the school
- Canley Vale Station, 2.5km from the school

Train stations are outside of the walking catchment, and all commutes from train stations will be connected via bus services. Students travelling from Fairfield Station will commute to school via. a nine minute commute on bus route 802. Bus services to and from the school are detailed further in section 2.3.1.

Fairfield and Canley Vale railway stations are on the T2 Airport, Inner West and South Line, and T5 Cumberland Line. The train lines provide services to the city centre, Schofields to the north-west, and Leppington and Campbelltown to the south-west.

Fairfield and Canley Vale have the following train frequencies departing in the relevant evening peak period:

T2 and T5 city-bound services every 15-30 minutes between 3-5pm

T2 and T5 south-bound services every 30 minutes between 3-5pm

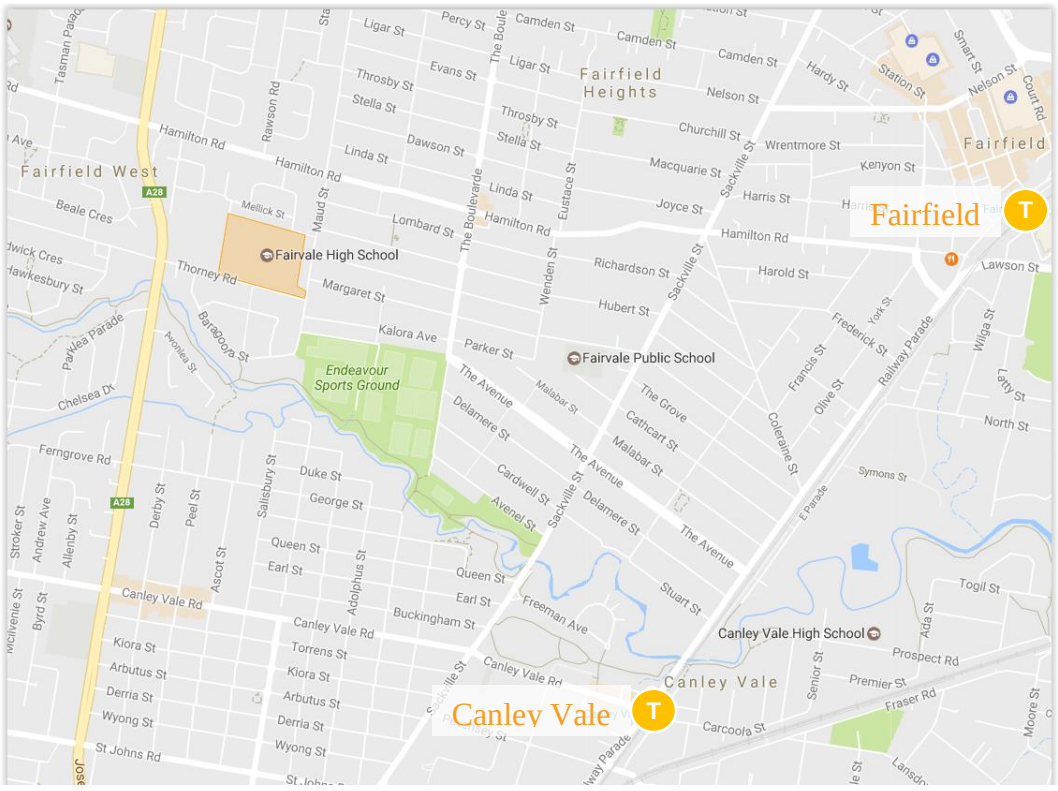


Figure 4: Train station locations

2.3.3 School buses

The school is served by an efficient system of school buses during peak hours, with the following frequencies:

- 9 school buses between 6:58am to 8:13am
- 7 school buses between 3:17pm to 4:11pm[1]

The school buses serve key locations at Fairfield Station, Wakeley and Bonnyrigg, with pick-up points located opposite the school on Thorney Road.

Arup conducted onsite surveys on 12 October 2017 during school peak hours, with the following observations:

Table 2: Number of students observed on each school bus during peak periods

School bus number	Time	Number of Fairvale High School students boarding / alighting
8062	8:15am	0
802	8:17am	15
9063	8:18am	0
9052	8:19am	10
802	8:32am	5
802	8:42am	5
802	3:30pm	29

Despite the school buses serving other schools, they were found to be no more than 50% occupied with spare capacity available.

Photograph 3: School bus arriving at 8:15am

[1] http://www.transitsystems.com.au/sydney/pdf/schools/FAIRVALE_HS.pdf

2.4 Pedestrian access

The primary pedestrian access points to Fairvale High School are illustrated in Figure 5. Staff utilise the staff car park via the vehicular access points 2 and 4. Access point 6 is closed to student and staff vehicular traffic. Waste management vehicles enter the site through access points 2 and 6.

Access points 3, 5, 7 and 9 are student entry/exit locations. Access point 8 is an additional public entry gate which is used by parents, visitors or deliveries with direct access to the administration. These gates are open during peak times but closed during the school day for security. Access point 3 provides access from the site to the adjacent Avery Park.

Figure 5: Main pedestrian access points

Thorney Road is the primary pedestrian and vehicular access area. Drop-off and pick-up bays for private vehicles and buses are provided along Thorney Road. The majority of students that have been dropped off on the southern side of Thorney Road by vehicles and buses are observed to utilise the crossing appropriately.

A pedestrian path connecting Thorney Road and Kambala Crescent provides a vehicular-free route for students walking to school from residential areas south of the school. The path is well connected to the zebra crossing across Thorney Road and is highly utilised by students in both the morning and evening peak periods as shown in Photograph 4.

Photograph 4: Pedestrian route between Thorney Road and Kambala Crescent

Photograph 5: Pedestrian crossing on Thorney Road

Students are also observed to enter via Avery Park, west of the school boundary. The students walk along an unpaved section and cross through the staff car park into the school. Photographs of the pedestrian route are shown below.

Photograph 6: Students utilising staff car park entry via Thorney Road

Photograph 7: Entrance 2 Entry to Avery Park via the car park.

2.5 Staff parking

Gated staff parking is provided on the western end of the school boundary. The car park can be accessed off Zarlee Street from the north, and Thorney Road from the south. The car park is closed to vehicular and pedestrian traffic between 5pm and 7am.

Occupancy surveys were carried out at the car park on 24 March 2017 at 9am, The survey was undertaken on a typical workday that is not on a school holiday or adjacent to a public holiday. The data provides the following findings:

- Total of 70 staff car parking spaces
- 8 spaces were unoccupied
- Based on 112 staff, approximately 55% parked on-site.

There is consideration that there are potentially additional staff parking on-street along the school frontage on Thorney Road. Some staff choose to park on street rather than on site, and the survey shows that there were 8 spaces unoccupied on site.

Photograph 8: Staff parking gate via Zarlee Street

Photograph 9: On-site staff parking

2.6 Accessibility

The current parking restrictions around the school street network is shown in Figure 6. Arup conducted parking occupancy surveys along the street network on 24 March 2017 at 8:30am.

The unrestricted spaces along Thorney Road were found to be occupied by residents, with occupancy rates of 80%. Other surrounding streets however had spare capacity, with occupancy rates between 10% and 30%.

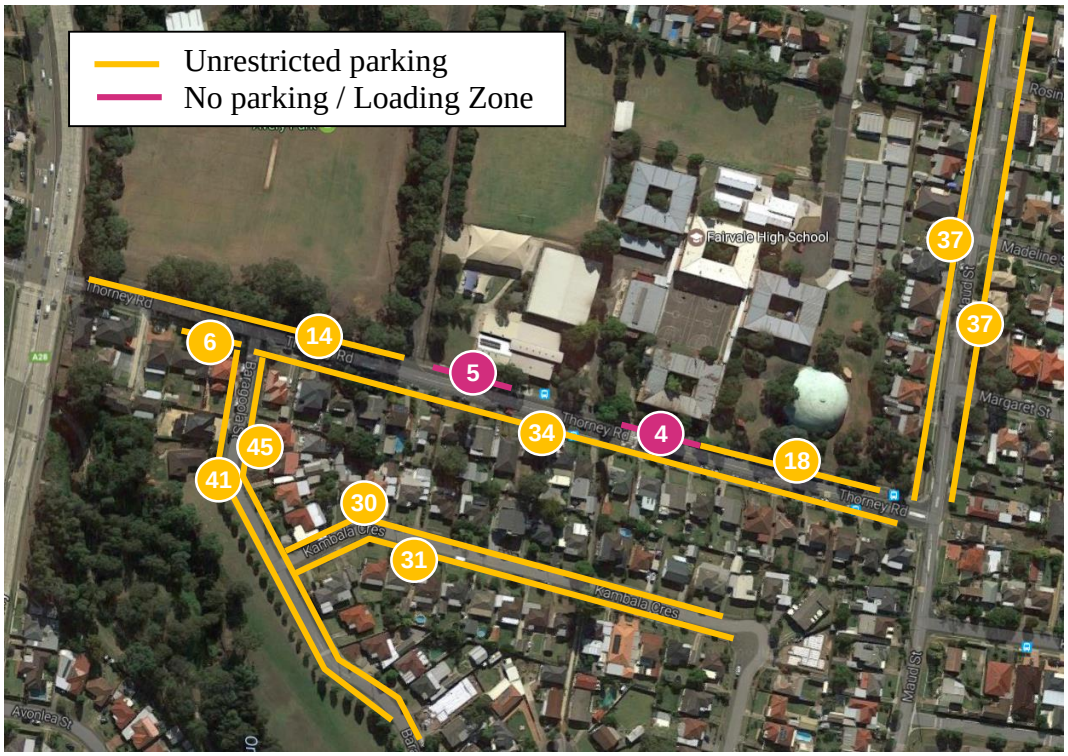


Figure 6: Current parking restrictions around the school and number of parking spaces

2.6.1 Drop-off

Drop-offs were found to operate efficiently from 8:30am to 9:00am. The school has some nine drop-off bays along Thorney Road, with the following restrictions:

- No Parking, 8am – 9:30am and 2:30pm to 4pm School Days
- Loading Zone, 7am – 4pm School Days

Drop-off bays were found to be no more than 70% occupied with a quick turnover of approximately 10 seconds observed. Queues were found to be periodically forming as a result of the zebra crossing. However these queues would clear once students have completed the crossing. Site observations indicated a large proportion of students walking to school from the local streets. A traffic warden could be considered to assist in students crossing the road at the zebra crossing during the morning drop-off period, to improve the flow of traffic and pedestrians.

Photograph 10: Thorney Road eastbound queue, photograph taken facing east

Photograph 11: Thorney Road westbound queue, photograph taken facing east

2.6.2 Pick-up

School ends at 3:05pm. During pick-up periods, the drop-off bays were found to have spare capacity. A large proportion of students were observed to walk and take the bus as shown in Photograph 12. Students were also observed to walk to parents that had parked along Thorney Road, Baragoola Street and Kambala Crescent.

Photograph 12: students walking and waiting for public or school buses

Photograph 13: Students crossing Cumberland Highway indicating a high walking mode share

Vehicular queues were found at the Thorney Road zebra crossing, however the queues did not affect the adjacent intersections. Teachers were found to control the flow of students and therefore traffic, assisting in the platooning of both pedestrians and vehicles. By 3:25pm, the roads and footpaths were found to be less busy, reflecting the short peak nature of the pick-up period between 3:05pm and 3:25pm.

Photograph 14: Thorney Road queues at 3:19pm

Photograph 15: Thorney Road clears by 3:25pm

Photograph 16: Baragoola Road queue at 3:12pm

Photograph 17: Baragoola Road clears at 3:20pm

2.6.3 Key findings

The road and footpath network is busy during the school pick-up and drop-off periods. Drop-off traffic arrives gradually over an hour, while the pick-up period sees a more intense arrival and departure of traffic over 20 minutes. Overall the drop-off and pick-up scheme is managed efficiently.

A traffic warden could be considered to assist in students crossing the road at the zebra crossing during the morning drop-off period, to improve the flow of traffic and pedestrians.

2.7 Car occupancy

In order to understand the nature of private vehicle trips made by students of the school, Arup has conducted on-site surveys on 12 October 2017 at drop-off / pick-up locations surrounding the school at Thorney Road and Tripoli Road (Figure 7).

The surveys recorded the number of students alighting / boarding each car, as well as the number of cars fetching students during the peak hours.

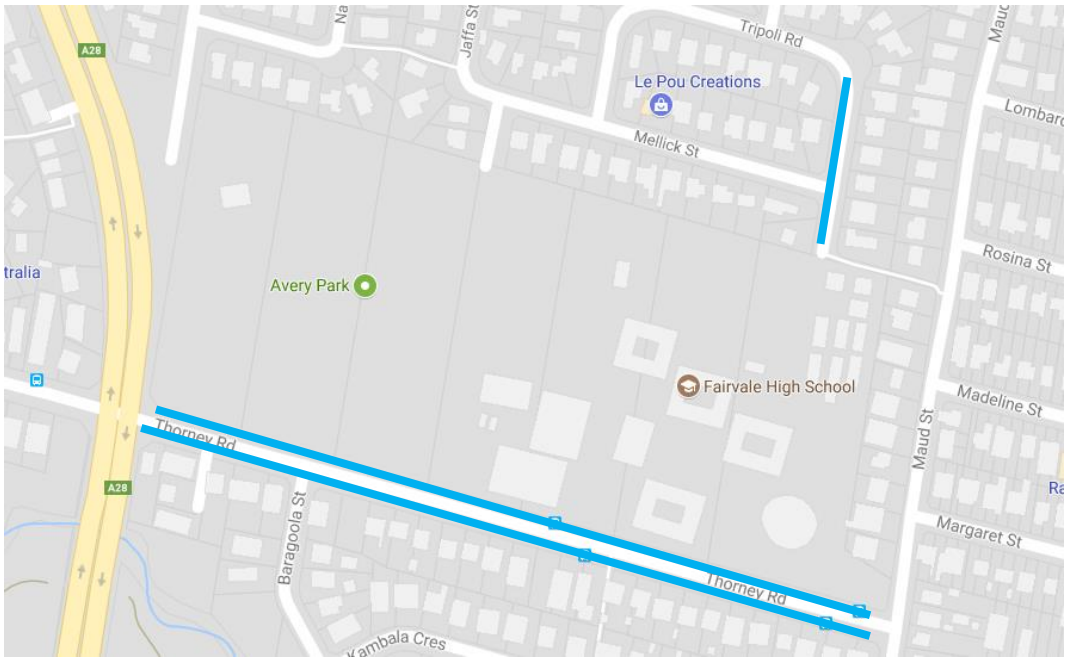


Figure 7: Car occupancy survey locations

2.7.1 Drop-off

During the survey period from 8:00am to 9:00am, a total of:

- 327 students arrived by cars
- 241 cars were recorded dropping off students
- An average 1.36 student to car occupancy rate was observed
- Based on an existing 1,360 students, a car mode share of 24%

2.7.2 Pick-up

During the survey period from 3:00pm to 4:00pm, a total of:

- 159 students departed by cars
- 132 cars were recorded picking up students
- An average 1.20 student to car occupancy rate was observed
- Based on an existing 1,360 students, a car mode share of 12%

2.7.3 Key findings

The travel mode share of students in Fairvale High School is efficient, with a large majority of students adopting alternative modes of transport such as walking or public transport, over private vehicles. More students were found to use alternative modes of transport after school with the mode share of each peak period shown in Figure 8.

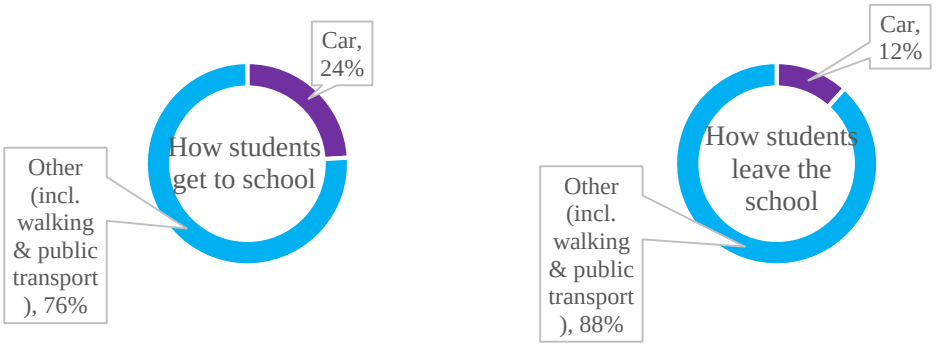


Figure 8: Mode share of students

The data collected indicates a higher proportion of public transport users in Fairvale High School, as compared to primary schools in the area, which were also surveyed. The observed car mode share and occupancy for Fairvale High School is also relatively similar to Killara High School which was surveyed in August 2017. Although they are related in different locations, the general transport provisions are similar in terms of distance from public transport and the number of enrolments and both are located in lower density residential precincts.

Killara High School is located along Koola Avenue, 1.6km from Killara Train Station, which is outside the walking catchment. Fairvale High School is also located outside the walking catchment for the train station, making this case study a viable example of student travel.

Killara High School has approximately 1,600 year 7 to 12 students enrolled. The high school is exemplary in showing that students can use sustainable travel alternatives such as school buses, walking and public transport. This is reflected by the well organised bus ranks and arrival times of school buses which were observed to be at capacity on most occasions.

In general, high school students are more independent and able to take public transport, resulting in a lower traffic generation rate per student.

3 Proposed upgrades

Fairvale High School has a current enrolment of:

- 1,360 students.
- 110 teaching and 23 non-teaching staff [2]

Expansion of Fairvale High school will facilitate the removal of demountable classrooms and will result in the upgrade of core facilities to the nine stream high school standards, 30 permanent teaching spaces and replacement of the Bini Dome with a new multipurpose hall.

This project will provide 30 permanent teaching spaces accommodating up to 600 students. This will produce a net gain of 10 additional teaching spaces above the current number of 89 (resulting in a total of 99 teaching spaces) and a net increase of 200 students (resulting in a total of approximately 1,560 students) and 10 additional staff (resulting in a total of 120 teaching staff and 143 total staff). A summary of the total net gains as a result of the upgrades are:

- +10 staff
- +200 students

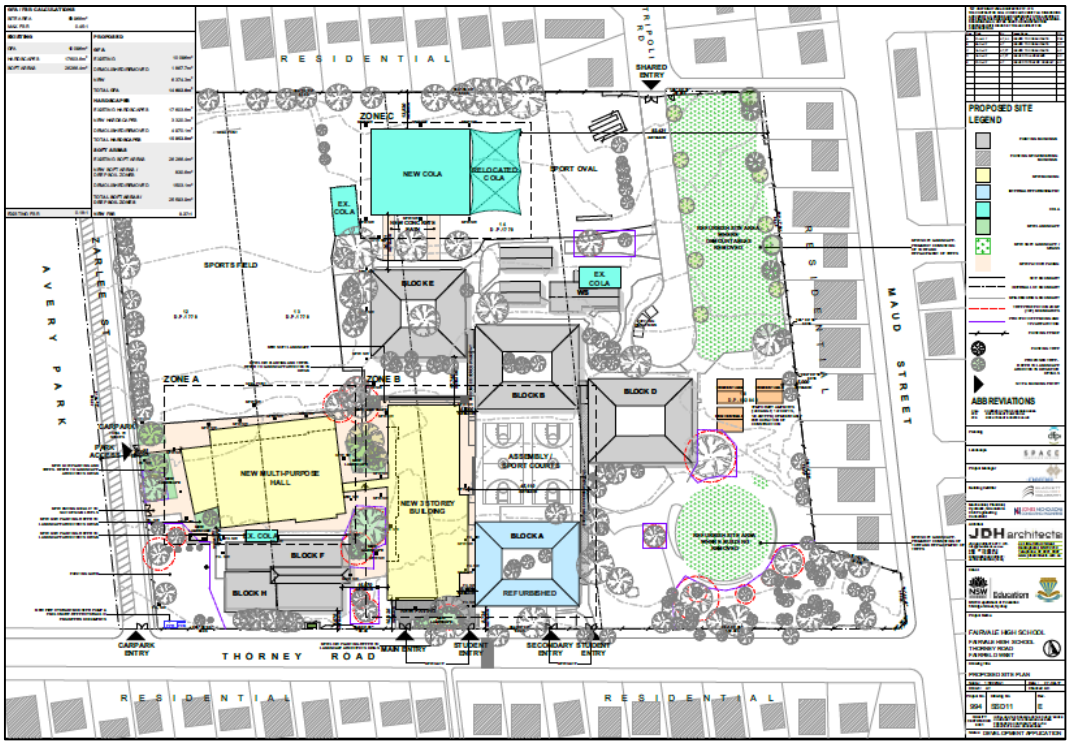


Figure 9: Proposed redevelopment (JDH architects)

[2] Source: My School – School profile: Fairvale High School, Fairfield West, NSW

3.1 Bicycle parking

3.1.1 Department of Education guidelines

The Department of Education website states that:

- Not all schools have the facilities to store students' bikes. The decision to install and maintain bike racks is made by the school. Some schools choose not to have bikes brought into the school. This may be due to safety reasons, or the inability to safely secure bikes. Principals have the authority to stop students from bringing bikes, scooters and skateboards onto school property.
- Bikes need to be stored in the area specified by the school. The school accepts no responsibility for loss, damage or theft. We recommend that students lock their bikes with a secure chain.
- The school may assist with safe storage of helmets if space permits.

Source: https://education.nsw.gov.au/road-safety-education/safe-student-travel/bikes

The school will provide additional bicycle parking based on future demand from students by monitoring the existing supply of bicycle parking.

3.2 Emergency vehicles and loading

Emergency and loading vehicles will access the site from the existing access located along Tripoli Road, shown in Figure 10. No changes are proposed as part of the development. The current location provides an efficient turning circle at the end of Tripoli Road. The existing number of service vehicles servicing the school is not likely to increase significantly as a result of the completion of the upgrades.

Figure 10: Existing emergency and loading access

4 Impact Assessment

4.1 Forecast traffic generation and distribution

The proposed upgrades for Fairvale High School estimate an additional 200 students and 10 staff. Based on site observations, the AM peak which coincides with the commuter peak was found to be busier than the school afternoon peak (which does not coincide with a commuter peak). Moreover, the afternoon school peak was found to have a significantly higher proportion of students taking public transport as discussed in section 2.7.

As such, modelling assessments will only consider the critical AM peak where traffic volumes are higher along the surrounding road network.

4.1.1 Staff

Based on Journey to Work 2011 data, 87% of workers travel by private vehicles. Using this proportion, approximately nine additional vehicular trips are forecast from the additional 10 staff. This will be used for the purpose of traffic modelling and is considered conservative when compared to the existing car parking occupancy levels which found only 55% of the staff parking on-site with some overflow on street.

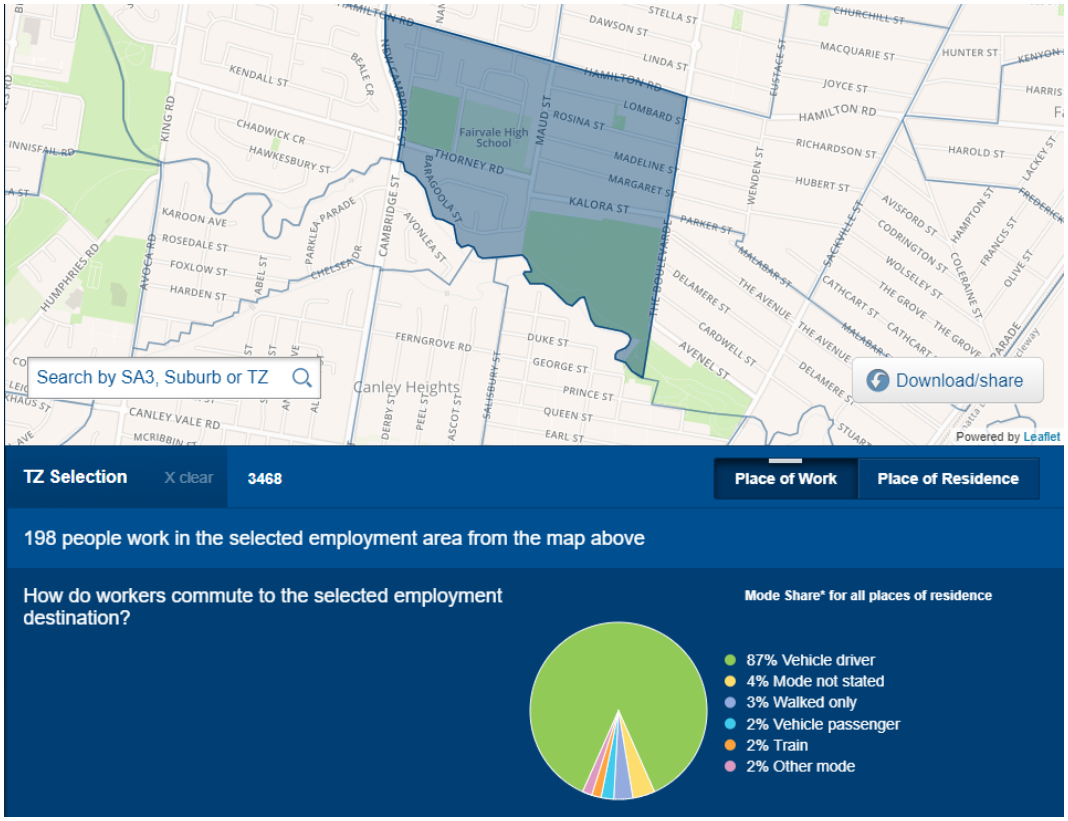


Figure 11: Journey to work

4.1.2 AM drop-off peak

Using the car occupancy rates discussed in section 2.7.1, the traffic generated by 200 additional students can be estimated:

- An average 1.36 students to car occupancy rate was observed
- Based on an existing 1,360 students, a car mode share of 24%
- 48 additional students arriving by cars
- 35 additional cars arriving between 8:00am and 9:00am

Adopting a similar existing arrival profile for the future additional 35 vehicles is shown in Figure 12. Additional vehicles are estimated to arrive in groups of 1 to 6 vehicles every 5 minutes. Existing drop-off bays were found to be no more than 70% occupied with a quick turnover of approximately 10 seconds observed, and would be able to accommodate the additional drop-off demand. Furthermore, this additional traffic will not be a major constraint on the operation of the surrounding road network.

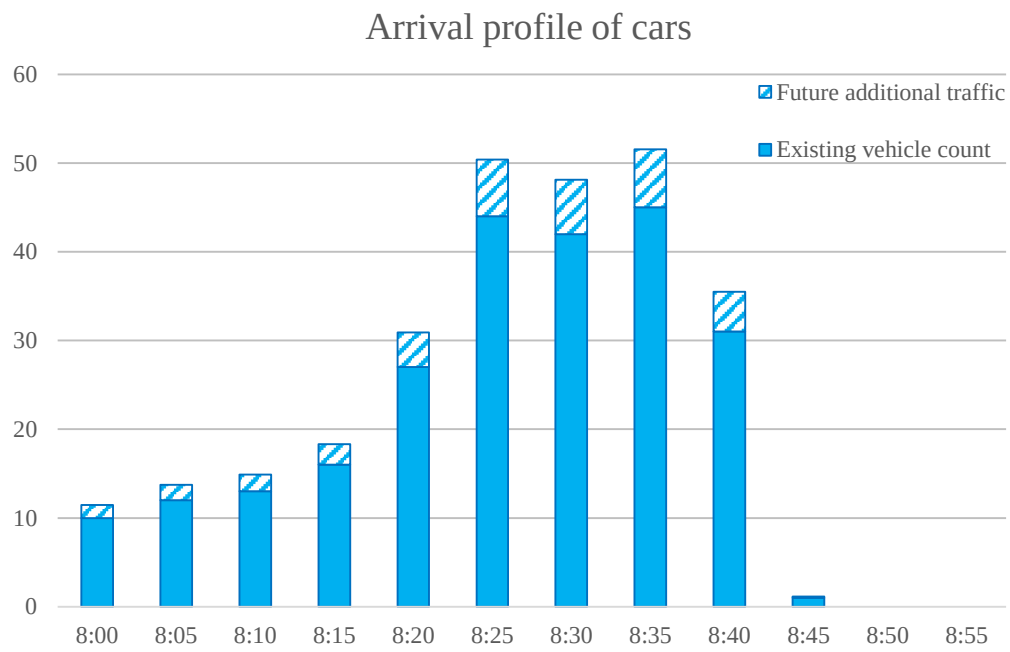


Figure 12: Arrival profile of cars inclusive of 35 extra cars upon completion of the school

4.1.3 Traffic distribution

The additional 44 (35 student drop-offs and 9 staff driving) vehicular trips are distributed based on existing traffic proportions entering Thorney Road from Cumberland Highway and Maud Street.

Of these vehicles, 61% of trips were observed to travel eastbound and 39% westbound towards the school entrance. Based on the assumptions, the forecast traffic distribution is summarised in Figure 13.

Vehicles entering from Cumberland Highway are assumed to exit via Maud Street. Conversely vehicles entering from Maud Street would exist via Cumberland Highway.

Section 4.2 details the impact these additional trips will have on the existing and future (upon completion of the school) road network surrounding the site.

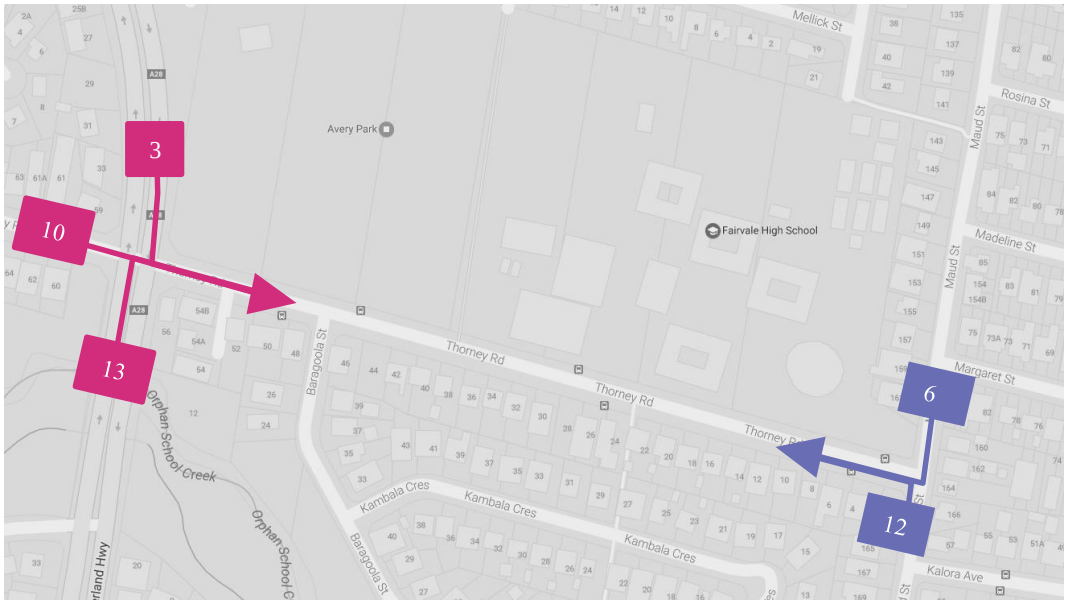


Figure 13: Forecast traffic distribution of additional student drop-offs and staff trips

4.2 Road network impact

4.2.1 Assessment criteria

The modelling extent used to assess the traffic generated from the proposed upgrade to Fairvale High School is shown in Figure 14. The intersections modelled for the assessment includes:

- Cumberland Highway and Thorney Road, and
- Thorney Road and Maud Street

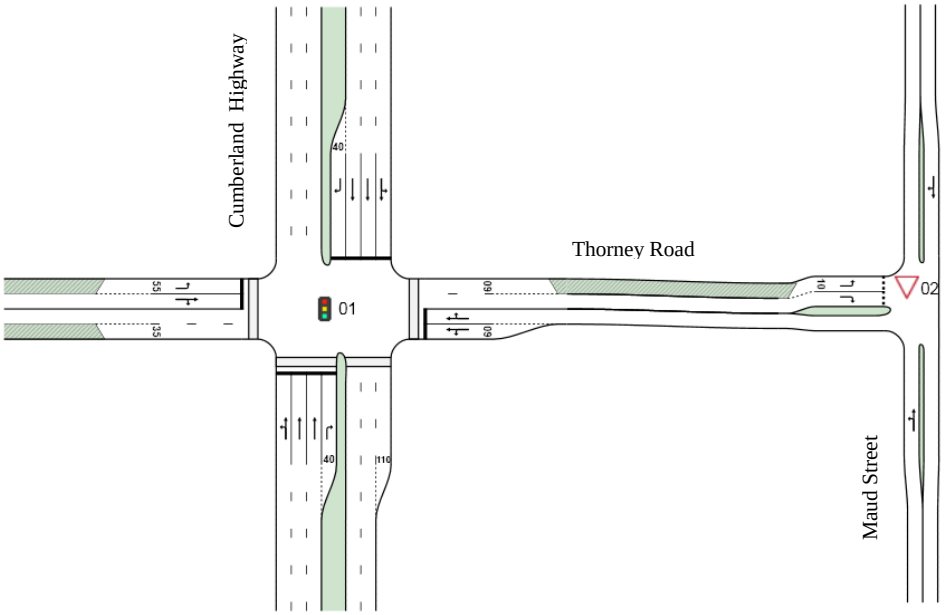


Figure 14: Traffic modelling extent

The intersections have been assessed using RMS approved software SIDRA Intersection software. The existing intersection performance is assessed in this report in terms of the following three factors for each intersection.

- Degree of Saturation
- Average Delay (seconds per vehicle)
- Level of Service

In urban areas, the traffic capacity of the major road network is generally a function of the performance of key intersections. This performance is quantified in terms of Level of Service (LoS), is based on the average delay per vehicle. LoS ranges from A = very good to F = unsatisfactory (see Table 2).

Table 3: Level of service criteria for intersections

Level of Service	Average delay (seconds)	Description
A	Less than 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At Capacity. At signals, incidents will cause excessive delays. Roundabouts require other control mode
F	Greater than 71	Unsatisfactory with excessive queuing

Another common measure of intersection performance is the degree of saturation (DoS), which provides an overall measure of the capability of the intersection to accommodate additional traffic. A DoS of 1.0 indicates that an intersection is operating at capacity. The desirable maximum degree of saturation for an intersection is 0.9.

Both intersections modelled have degrees of saturation below 0.5, both currently and following the completion of the school. This indicates that the intersections are performing well, and will not be constrained by the future additional trips generated by the site. As such, additional funding for upgrades or road improvements is not required.

The existing scenario SIDRA models were calibrated to match existing queue lengths observed during the site visit.

The results of the surrounding intersections are summarised in Section 4.2.1. This includes the following scenarios:

- Existing scenario to calibrate to existing traffic conditions
- Existing traffic with addition of school generated traffic

4.2.2 Modelling results

The results of the traffic modelling undertaken for the existing and future impact of the additional school-generated traffic are summarised in Table 4. Traffic modelling indicates that there would be no significant impact to the existing network performance upon completion of the school. Key intersections would continue operating efficiently at a level of service A or B. The SIDRA results are contained in

The right turn movement from Cumberland Highway south into Thorney Road east has the largest increase in traffic flow of 13 vehicles in the morning peak. The results indicate the right turn bay will continue to provide adequate capacity with only a minor increase in delay from 27 seconds to 28 seconds.

While the model indicates efficient results, it should be noted that the performance levels are an average over the morning peak hour between 8:00am to

9:00am. Queue lengths caused by the zebra crossing are not captured by the model. However, the modelling results provide an understanding of the current and future operations of the intersections.

Table 4: Traffic modelling results

Scenario	Intersection	Overall Level of Service	Average delay (sec)	Degree of saturation	95%tile queue (m)
Existing	Cumberland Highway / Thorne Road	B	22	0.43	98
	Thorney Road / Maud Street	A	5.1	0.11 (South)	3 (West)
Future, upon completion of school	Cumberland Highway / Thorne Road	B	22	0.37	98
	Thorney Road / Maud Street	A	5.1	0.12 (South)	3 (West)

4.3 Public transport impacts

As discussed in section 2.3, existing school buses and public buses serving the school have spare capacity. The addition of 200 students spread across the various modes of transportation are estimated below:

- 12 students leave school by car (see section 2.7.3)
- 188 students leave by other modes
  - 50% walk (94 students)
  - 30% by public bus (56 students)
  - 20% by school bus (38 students)

The impact of the proposed development on future public transport infrastructure within the vicinity of the site is to be determined in consultation with Roads and Maritime Services (RMS) and Transport for NSW (TfNSW).

4.4 Student drop-off impact

4.4.1 Drop-off

Drop-off bays were found to be no more than 70% occupied with a quick turnover of approximately 10 seconds observed. Existing drop-offs were found to operate efficiently from 8:30am to 9:00am. The school has some nine drop-off bays along Thorney Road. These bays were not observed to reach full occupancy. Additional vehicles are estimated to arrive in groups of 1 to 6 vehicles every 5 minutes (section 4.1.2).

As such, the additional 35 vehicular trips estimated from students can be accommodated within the existing nine drop-off bays.

A traffic warden could be considered to assist in students crossing the road at the zebra crossing during the morning drop-off period, to improve the flow of traffic and pedestrians.

4.4.2 Pick-up

During pick-up periods, the drop-off bays were found to have spare capacity. A large proportion of students were observed to walk and take the bus. Students were also observed to walk to parents that had parked along Thorney Road, Baragoola Street and Kambala Crescent. These parking areas had spare capacity with an abundance of additional parking located within walking distance of the school. The impact of additional pick-up activity is likely to be minimal with students adopting active and public transport, shown in section 2.6.2 and 2.7.2.

4.4.3 Key findings

The school is served by a network of public and school buses which provide services to the Fairfield and Canley Vale train stations. A majority of students were found to walk or adopt public transport. Existing drop-off / pick-up bays are sufficient and can accommodate the additional 35 vehicles. Additional drop-off and pick-up activity is unlikely to affect the surrounding road network adversely.

4.5 Pedestrian Safety

A pedestrian path connecting Thorney Road and Kambala Crescent provides a vehicular-free route for students walking to school from residential areas south of the school. The path is well connected to the zebra crossing across Thorney Road and is highly utilised by students in both the morning and evening peak periods. The level of student increase can easily be accommodated by the existing pedestrian facilities.

The pick-up and drop-off activity was observed to occur in an efficient and safe manner and this is expected to continue with increased activity.

4.6 Staff parking / DCP requirements

4.6.1 Comparison to other DCP requirements

A list of the different parking requirements of nearby precincts are summarised in Table 5. Given that these precincts are likely to have a similar demography and geography, they can be used as a comparison. The information shows that the Fairfield DCP requires twice as many parking spaces as the Auburn DCP 2010 recommendations.

The Parramatta DCP does not provide a specific rate for school parking requirements which is a more progressive position which encourages sustainable travel habits through the implementation of green travel plan initiatives and less reliance on private vehicle usage which has a direct correlation to parking spaces provided.

Table 5: Comparison of school parking requirements based on three different DCPs

Measure	Staff	Students
Fairfield DCP	1 space per 1 staff	1 space per 20 year 12 students +
Auburn DCP 2010 Table 10 (secondary school)	1 space per 2 staff	1 space per 20 year 12 students +
Parramatta DCP 2011	No minimum requirements	No minimum requirements

4.6.2 Existing FDCP requirements

The Fairfield City Wide Development Control Plan (FDCP) Amendment 13 provides a guideline on the number of parking spaces which should be provided for schools. The DCP stipulates *'1 space per employee plus 1 space per 10 students in Year 12'*.

An outline of the existing school parking is provided in section 2.5. By providing one space per employee, the DCP guidelines assume that all staff members own a car, with all of them driving to school every working day. The provision of parking spaces for year 12 students also encourages the usage of private vehicles and generally creates problems with space allocations.

Based on the DCP rates, a total of 134 existing parking spaces are required. The school currently provides 70 spaces, which were found to have spare capacity.

Table 6: Existing parking requirements based on FDCP

Measure	DCP spaces required	Total DCP requirement
112 existing staff	1 per 1	112
~226 existing year 12 students	1 per 10	22
Total		**134**

4.6.3 Future FDCP requirements

The proposed works will result in an additional 10 staff and 200 students. Based on the Fairfield DCP requirements, an additional 12 spaces are required, or a total of 146 (134+12) parking spaces, shown in Table 7. This is considered excessive given the current availability of 70 existing spaces are not fully occupied.

Table 7: Future school parking requirements based on FDCP

Measure	DCP spaces required	Total DCP requirement
10 staff	1 per 1	10
~17 year 12 students	1 per 10	1.7
Total		**~12**

4.6.4 Future ADCP comparison

Using the Auburn DCP rates as a comparison, the school will require 61 spaces for staff and 24 spaces for year 12 students. Considering only staff, this requirement is below the current provision of 70 staff parking spaces on the site.

Table 8: Future school parking requirements based on ADCP

Measure	DCP spaces required	Total DCP requirement
122 staff	1 per 2	61
~243 year 12 students	1 per 10	24.3
Total		**~85**

4.6.5 Existing parking requirements based on site visits

Occupancy surveys were carried out at the on-site school car park on 24 March 2017 at 9am, with the following findings:

- Total of 70 staff car parking spaces
- 8 spaces were unoccupied
- Based on 122 staff, approximately 55% drive and park on-site.

As seen from current occupancy rates, a much lower proportion of staff drive than the DCP recommendation of a 100% driver rate. The school car park does not provide any parking for year 12 students.

Therefore, adopting a first principle approach would allow the most economic usage of resources. Assuming 80% of the additional 10 staff drive equates to 8 additional vehicles. This can be accommodated in the existing 70 staff car parking spaces which currently has 8 spaces unoccupied.

4.6.6 The Department of Education (DoE) Policy on Parking

The NSW Department of Education promotes the use of sustainable transport initiatives. This is supported by the Department's Educational Facility Standards and Guidelines (EFSG), which encourage the use of public transport and require parking on site to be minimised for staff within educational facilities. A copy of the EFSG has been included in Appendix A. Section PS610.17 Services Zone states:

"In order to ensure that the available site area for teaching learning and play is maximised, to enable community use and to encourage the use of sustainable means of transport to and from the school, on school site parking should be kept to a minimum."

In addition, The Motor Vehicle Policy for NSW Government Agencies v13.0.14 April 2014, Section 4.8 does not entitle parking spaces for private use vehicles. The document states:

"For 100% private use vehicles (whether owned, novated or 100% Departmental or Agency packaged) are not entitled to a parking space on Government leased or owned premises."

In addition the Premier's Memorandum for Government Property NSW (Principle 11 in the Premier's Memorandum 2008-2006 and now Principle 12 in the Premier's Memorandum 2012-2020) does not advise the entitlement to employees for car parking. Principle 12 states the following:

"Principle 12

Car parking spaces that incur a cost to an agency should only be provided for official government vehicles including vehicles supplied under salary sacrifice arrangements used for official business. There are circumstances where approval has been given by CEOs for the parking of private motor vehicles in official car spaces. These approvals have been given on the basis of the particular needs of the agencies concerned. Pending finalisation of a sector-wide policy in respect to these motor vehicles, existing approvals are to remain in force."

Whilst Council's DCP details the minimum parking requirements for developments, Clause 11 of the State and Regional Development SEPP provides that DCPs do not apply to State Significant Development. As such, reference needs to be made to similar developments and alternative guidelines.

The RMS Guide to Traffic Generating Developments does not provide details of parking for educational establishments, but requires designers to refer to details of similar developments, ie to similar educational establishments.

It is therefore appropriate to consider the parking requirement for the school on the basis of the location and surrounding conditions to determine what is an appropriate level of parking

4.6.7 Key findings

DCP comparison

With the varying demographics and travel behaviour of schools, and the spread in locations of each school within Fairfield City Council, it is difficult to adhere to a fixed set of parking requirements. Multivariate factors such as public transport availability and general culture of the school influence travel decisions. As such, each school should be examined on an individual basis.

In the case of the proposal, the FDCP rate is viewed as excessive when compared to the Auburn and Parramatta DCP rates.

Effects of increased staff parking

Site visits observed 8 of the 70 spaces were unoccupied. Assuming 80% of the additional 10 staff drive equates to 8 additional vehicles. This can be accommodated in the existing 70 staff car parking spaces which currently has 8 spaces unoccupied. Based on the current staff demographics and car parking trends, an increase in staff numbers would not result in an overflow of staff parking to the surrounding on-street spaces.

Effects of overflow staff parking and increased student parking

The unrestricted spaces along Thorney Road were found to be occupied by residents, with occupancy rates of 80%. Other surrounding street however had spare capacity, with occupancy rates between 10% and 30%.

Should the existing staff car park result in more demand than supply, overflow staff parking can be accommodated within the surrounding local streets within a 150 metre walking catchment. This number is expected to be minimal with negligible impacts to the existing on-street parking demand and supply. On-street parking surveys discussed in section 2.6 indicate an abundance of unoccupied and unrestricted parking spaces.

Assuming 1 in 10 year 12 students drive would result in approximately 2 additional cars being parked on-street. This will not affect the surrounding on-street parking condition adversely.

4.7 Encouraging staff to adopt green travel

To minimise the unlikely impact of on-street parking by staff and students, the school can implement green travel strategies, discussed in section 5.

5 Strategies / Transport Management Plan

This section discusses the various transport strategies which the school may implement for staff. These initiatives aim to:

- Reduce parking demand from staff
- Reduce private vehicle usage of staff
- Reduce traffic congestion and improve existing intersection performance

5.1 Staff Green Travel Plan

To minimise the impact, the effects of on-street parking by staff, the school can implement green travel strategies for staff (and the wider school community). These solutions are easy and cost effective:

- Staff carpool, the school can help organise a system which will reduce single private vehicle car trips to the school (explained further below)
- Encourage staff to take public transport / active transport by making it inclusive and entertaining:
    - Host active travel events – such as 'Ride to Work Days'
    - Safe riding days / demonstrations
    - Communication of benefits and measurements of improvements

5.1.1 Active Transport/ Bike/ Scooter

As described in section 3.1, the school has good access to the cycling network and will provide onsite facilities for cyclists (i.e. easily accessible bike room/shelter, changing rooms and showers, lockers etc.) based on future demand from students by monitoring the existing supply of bicycle parking. In order to activate and promote cycling the following measures should be considered:

- Come to an arrangement with a local cycle retailer for cheap servicing of student and staff bikes. If people buy enough bikes from the retailer, they may agree to service them for free;
- Provide cycle maps to staff and students;
- Participate in annual events such as 'Ride to Work Day';
- Notice boards should have news of events / generic posters promoting cycling;
- Make staff and students aware of public transport cycling carriage policies and cycle storage facilities at rail stations;
- Staff and students who cycle should be encouraged to form a Bicycle User Group in order to provide a body of regular cyclists who can discuss on issues relating to the provision of on-site cycling facilities and the maintenance of off-site cycle routes; and
- Set up 'Bike Buddies' scheme for less confident people interested in cycling.

5.1.2 Carpooling

Possible ways to further encourage carpooling may include staff registering their interest in carpooling by indicating where they live and matching their shift times with colleagues.

Under this scheme, the school would set up a system where real-time carpool information from participants can be displayed or changed. Schedules can be managed through a cloud, Google Maps or various smartphone applications. Carpooling should be a long term initiative. With consistent promotion of this travel mode and incentives, staff should be aware of the benefits and convenience.

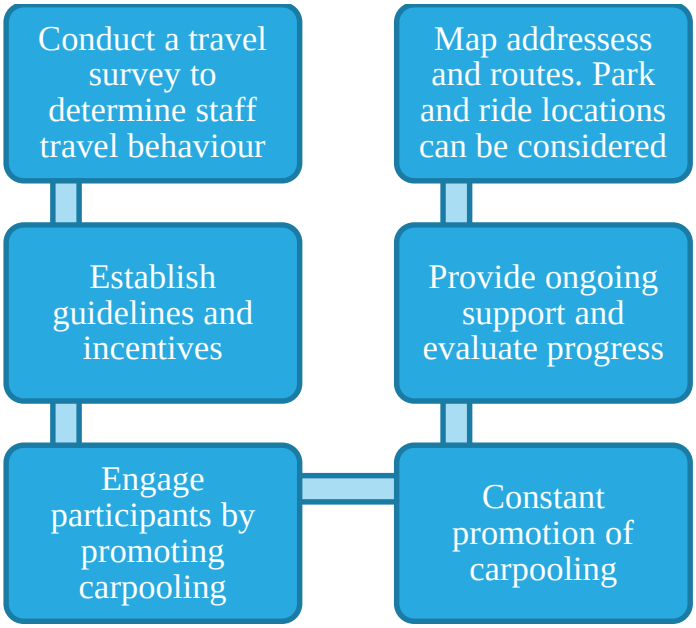


Figure 15: Setting up carpooling for staff[3]

5.1.3 Pool cars and taxi share

In order to reduce the number of car trips and especially trips made to common destinations the following measures should be considered:

- Set up a journey to/from school car share system for all staff who are willing to participate in the scheme and dedicate at least one car space for this use. The system would inform participants of other staff who live in the same area or who pass through the area on their way to the schools. The participants either share the costs or alternate in driving to the schools;
- Utilise a range of free apps are currently available online to assist with the implementation of this initiative. The schools will need to investigate the most appropriate app that aligns with its Child Protection Policies before promoting this initiative; and
- Introduce a taxi or pool car share system for trips during the day for staff.

[3] http://www.transport.wa.gov.au/mediaFiles/active-transport/AT_TS_P_Car_Pooling_Toolkit.pdf

5.2 Student Green Travel Plan

A range of travel method alternatives have been recommended as well as incentives to change travel behaviour over the short and longer term period. The purpose is to encourage mode shifts away from private vehicle usage and create a positive outlook for active transport.

These initiatives aim to improve the existing and future conditions of campus population increase by:

- Reducing private vehicle usage (pick-ups and drop-offs) from students
- Reducing traffic congestion and improving intersection performance

The modal shift associated with these travel methods aim to reduce car trips to the development so there is no net impact from School population and proposed development increases on existing traffic conditions.

5.2.1 General Marketing and Promotion

The objectives of the Green Travel Plan will only be achieved with the support of staff and student's parents. Marketing the benefits and promoting the sustainable alternatives available are therefore crucial in encouraging staff and students to adopt the Green Travel Plan measures. It is important that at an early stage, everyone is made aware of the need for the Green Travel Plan, and that it is emphasised that the measures are being introduced to support and encourage people to use cars more wisely.

In addition to raising general awareness, any successes achieved will be fully publicised to staff and students in order to motivate them to use sustainable modes of transport.

- Support and promote events such as National Bike Week, Bike2Work Days, walk to work day to staff through lunch time presentations or students during assembly, notice board posters, newsletters intranet and email.

5.2.2 Public Transport

To promote the use of public transport for travel to school and school-related journeys during the day.

- Manage the student drop-off and pick-up areas surrounding the schools;
- Provide an intranet public transport page to contain useful links to journey planning websites in Sydney;
- Provide useful public transport maps and promotional items to potential and current public transport users in the existing induction pack for new employees; and
- Provide notice boards that should have news of events / generic posters promoting public transport.

5.2.3 Walking

Specific Travel Plan measures designed to encourage more walking trips to and from the schools by those staff and students living within a reasonable distance.

- Produce a map showing the most direct route connecting the transport interchange and schools, along with the estimated walking time;
- Produce walking related articles for inclusion in the school newsletters focussing on ‘walking champions’ to highlight best practise in walking;
- Create and maintain an intranet ‘useful walking routes’ containing useful routes to key areas;
- Make pedometers available to staff and students expressing an interest in walking to school; and
- Participate in Walk to Work day and look into holding a ‘healthy breakfast’ as a reward to all those who participate.

5.3 Scheme Administration

5.3.1 Administration

An essential part of an effective Green Travel Plan is to nominate a Travel Plan Co-ordinator for students. The role should be undertaken by enthusiastic and high quality communicators in order to promote measures that will encourage people to think about travel other than as a single occupancy car user. He/she will need to be an enthusiastic and respected member of staff who is keen to champion the cause of the Travel Plan. Other qualities that may be appropriate include the capability of dealing with all types of people within the schools and external organisations, the ability to lead by example, the ability to approach issues with a practical and balanced perspective and the capability for original and innovative thinking to raise awareness of the Travel Plan at a local level.

Senior management support is critical to ensuring the success of any travel plan for a number of reasons such as to:

- Lead by example;
- Allow budget allocations for the implementation of measures; and
- Give support to changes or development of policy documentation.

Administration of the Travel Plan involves the maintenance of necessary systems, data and paperwork, consultation and promotion.

5.3.2 Promotion

All students and staff will be made aware of the details of the Green Travel Plan, its objectives in enhancing the environment and the role of individuals in achieving its objectives at its launch.

Other promotional material will take a variety of forms and will be issued either to individual staff members and students, displayed in a prominent location in the

school or provided in the form of 'one off' marketing initiatives. This would include outlining the benefits for the school in participating in government travel surveys to both improve public transport services and promote the use of public transport.

The promotional material will advise employees wishing to raise specific transport-related matters to discuss them with the appropriate nominated Travel Plan co-ordinator who in turn would liaise with the Green Travel Plan management team, transport operators and the local authority as required.

5.3.3 Staff Induction

To ensure new members of staff are aware of the Green Travel Plan, all new staff members should be made aware of the Plan as part of their induction process. The Green Travel Plan section of the induction should provide new starters with the following:

- A brief introduction to the Green Travel Plan and its purpose;
- Tour of the schools to include visit cycle parking areas and shower and changing facilities where provided; and
- Provision of a Green Travel Plan information package which would include information on incentives to use sustainable means of transport e.g. pool bikes and car/taxi share system.

5.3.4 Consultation

The success of the Green Travel Plan will rely on the support of the employees which will be overseen by the Green Travel Plan co-ordinator.

The Green Travel Plan co-ordinator will be responsible for all liaisons with outside bodies, including local transport operators, planning and highway authorities.

Liaison with officers of the Council (e.g. those responsible for cycling and public transport will be undertaken as required). The co-ordinator will also seek to join and attend meetings with any local travel forums as appropriate in order to exchange ideas with other like-minded organisations.

5.3.5 Updating, reviewing and monitoring

The Green Travel Plan is a strategy that will evolve over time. Although the objectives of the Plan to 'educate' students and staff, and to facilitate travel by sustainable modes will not change, it may be possible over time to define or re-define specific targets.

Target setting should reflect an ambition for continued progress year on year and there should be a mechanism to review targets in light of monitoring surveys. The monitoring measures could include collecting data on travel patterns for journeys to school and also during the school hours. The recorded data would inform modes of transport and distance travelled by each mode, from which energy consumption and emissions could be estimated.

Following the implementation to the Green Travel Plan, the Green Travel Plan management team should meet annually to undertake a review of the Travel Plan measures in place. The objective will be to measure their success and to identify the potential for refinements. The plan would be updated to consider firmer details of the initiatives of the NSW Long Term Transport Masterplan, as they are forthcoming. The management team will further engage with Government to assist in designing and operating services which best support the needs to the students and staff, and therefore promote high levels of sustainable transport modes.

The Green Travel Plan management team will then compile a review report outlining the results of the review. The report will also incorporate the results of on-going monitoring processes throughout each of the preceding periods.

6 Conclusions

Expansion of Fairvale High School will result in the upgrade of core facilities to a 9 stream high school, 30 new teaching spaces and replacement of the Bini Dome with a multipurpose hall.

This project will provide 30 permanent teaching spaces accommodating up to 600 students. This will produce a net gain of 10 teaching spaces, taking the total capacity to 1,560 students which represents a net increase of 200 students. Key findings of the traffic and transport report are:

- The school is served by a network of public and school buses which provide services to the Fairfield and Canley Vale train stations, along the primary roads of Hamilton Road, Canley Vale Road and Joseph Street.
- During existing drop-off periods, queues were found to be periodically forming as a result of the zebra crossing. However these queues would clear once students have completed the crossing. A traffic warden could be considered to assist in students crossing the road at the zebra crossing during the morning drop-off period, to improve the flow of traffic and pedestrians.
- Site observations indicated a large proportion of students walking to school from the local streets. The travel mode share of students in Fairvale High School is efficient, with a large majority of students adopting alternative modes of transport, such as walking or public transport, over private vehicles.
- During existing pick-up periods, the drop-off bays were found to have spare capacity. By 3:25pm, the roads and footpaths were found to be less busy, reflecting the short peak nature of the pick-up period between 3:05pm and 3:25pm. The surrounding roads therefore experience a short period of high activity, rather than a prolonged period.
- A total of 44 additional vehicular trips are estimated as a result of the proposed development. Following the modelling of surrounding intersections, these additional trips will not constrain the surrounding road network.
- Traffic modelling indicates that there is no significant impact to the existing network performance.
- Given the availability of space, additional drop-off and pick-up activity is unlikely to affect the surrounding road network adversely.
- A comparison and assessment of current Fairfield DCP rates is included in the report. It was found that the Fairfield DCP parking rate is excessive when compared to the Auburn and Parramatta DCP rates, and particularly so for Fairvale High School (given the existing car park vacancies). These nearby precinct DCP rates were used as a comparison given the relatively similar demography and geography of the precincts.
- Observations indicated the current parking on site was not fully utilsied with 8 of the 70 spaces unoccupied. Future staff parking requirements can be accommodated in the existing staff car park.

- A green travel plan has been included in this report to further promote alternative modes of travel to the school by staff and students. This should encourage a modal shift away from private vehicle usage and foster active transport.

The school has a healthy culture of adopting public transport or walking as modes of transport. Traffic generation levels are not predicted to be high based on site analysis and observations. Completion of the school will not affect the surrounding road network adversely. As such, no additional car parking or bicycle racks are required.

Appendix A

Department's Educational Facility Standards and Guidelines - Section PS610.17 Services Zone

Published on *NSW Department of Education - EFSG* (https://efsg.det.nsw.edu.au)

PS610.17 Services Zone

FUNCTION AND LOCATION

Function:

- Landscape design to reduce the visual impact of services
- Consider the siting of the zone in relation to the rest of the school landscape

Location:
Easily accessed from roads or driveways for maintenance and metering

PLANNING

The services zone supports the day to day functioning of the school. It includes supporting infrastructure such as car parks, bicycle racks, service roads, bulk waste pads, fire hydrants and LPG tank enclosures. This infrastructure can be integrated with built structures or screened as necessary.

Service areas must be considered as an integral part of the school design. The siting of these facilities should balance the needs of amenity and security. Planting may be used to screen services from particular vantage points, while security may require clear views of that service from other areas.

In order to ensure that the available site area for teaching, learning and play is maximised, to enable community use and to encourage the use of sustainable means of transport to and from the school, on school site parking should be kept to a minimum. The parking numbers indicated in the EFSG accommodation summary are maximums and should only be provided when a site specific traffic report indicates that these numbers are required taking into account the location of the facility, public transport links, cycle routes etc.

Adequate space should be provided in car parks for tree planting to provide visual amenity and shade.

Cycle facilities can be located adjacent to buildings, which provide a level of security and weather protection.

PLANNING CRITERIA AND CONSIDERATIONS

CRITERIA	CONSIDERATIONS
Microclimate	Avoid heat and glare from paved surfaces.
Context	Consider relationship of service to surrounding buildings and street - noise, odour, function, views.

Biodiversity Recovery	Low opportunity due to amount of hard paving required for most services.
Pedestrian movement	Separate service access from student use/ activity zones. Prevent student access in potentially dangerous areas.
Shade	Allow clear sightlines to vehicles from adjacent buildings.
Winter solar access	Maintain to key spaces in adjoining buildings.
Furniture	Not required.
Water	Consider desire lines and spill out from edges of paving.
Erosion	Consider desire lines and spill out from edges of paving.
Surface finish	Paved to civil engineers design.
Solar glare	Bright, reflective areas to be avoided.
Allergenic plants	Plants that may cause allergies may be able to be used if there are no suitable alternatives, as student use is restricted.
Stormwater	Incorporate services pits within paved areas, rather than turf or planting beds. Provide for naturally landscaped drainage treatments e.g. planted swales, retention basins, and permeable surfaces.
Lighting	Refer Schools Facilities Standards.
Signage	Any services used by the public e.g. visitor car parks (refer Schools Facilities Standards and Specification Standard).
Maintenance	Low level due to restricted student access.

Appendix B

Intersection SIDRA results

MOVEMENT SUMMARY

Site: 01 [Cumberland Hwy / Thorney Rd Existing]

Cumberland Hwy / Thorney Rd
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cumberland Highway											
1	L2	30	0.0	0.263	17.7	LOS B	9.5	66.4	0.48	0.45	48.6
2	T1	934	0.0	0.263	12.1	LOS A	9.5	66.7	0.48	0.43	49.9
3	R2	125	0.0	0.274	26.8	LOS B	5.1	35.5	0.66	0.75	40.8
Approach		1089	0.0	0.274	14.0	LOS A	9.5	66.7	0.50	0.46	48.7
East: Thorney Road											
4	L2	135	0.0	0.167	30.9	LOS C	5.5	38.5	0.64	0.74	38.8
5	T1	59	0.0	0.232	48.3	LOS D	4.8	33.4	0.86	0.71	32.8
6	R2	26	0.0	0.232	53.8	LOS D	4.8	33.4	0.86	0.71	32.5
Approach		220	0.0	0.232	38.3	LOS C	5.5	38.5	0.73	0.73	36.2
North: Cumberland Highway											
7	L2	30	0.0	0.215	27.9	LOS B	7.7	54.1	0.62	0.56	42.4
8	T1	809	0.0	0.355	23.7	LOS B	13.9	97.5	0.66	0.57	43.1
9	R2	26	0.0	0.105	33.7	LOS C	1.1	7.8	0.65	0.70	38.1
Approach		865	0.0	0.355	24.1	LOS B	13.9	97.5	0.66	0.58	42.9
West: Thorney Road											
10	L2	89	0.0	0.179	18.0	LOS B	3.0	20.8	0.59	0.68	46.0
11	T1	102	0.0	0.433	42.6	LOS D	8.7	60.6	0.84	0.75	34.2
12	R2	66	0.0	0.433	56.6	LOS E	8.7	60.6	0.91	0.77	31.8
Approach		257	0.0	0.433	37.7	LOS C	8.7	60.6	0.77	0.73	36.7
All Vehicles		2431	0.0	0.433	22.3	LOS B	13.9	97.5	0.60	0.56	43.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	51.5	LOS E	0.2	0.2	0.86	0.86
P2	East Full Crossing	50	24.7	LOS C	0.1	0.1	0.59	0.59
P4	West Full Crossing	50	24.7	LOS C	0.1	0.1	0.59	0.59
All Pedestrians		150	33.6	LOS D			0.68	0.68

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 01 [Cumberland Hwy / Thorney Rd Upgrades]

Cumberland Hwy / Thorney Rd
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cumberland Highway											
1	L2	30	0.0	0.263	17.7	LOS B	9.5	66.4	0.48	0.45	48.6
2	T1	934	0.0	0.263	12.1	LOS A	9.5	66.7	0.48	0.43	49.9
3	R2	142	0.0	0.312	28.1	LOS B	6.0	42.1	0.69	0.76	40.2
Approach		1106	0.0	0.312	14.3	LOS A	9.5	66.7	0.50	0.47	48.4
East: Thorney Road											
4	L2	135	0.0	0.167	30.9	LOS C	5.5	38.5	0.64	0.74	38.8
5	T1	59	0.0	0.203	43.8	LOS D	4.5	31.8	0.82	0.69	34.2
6	R2	26	0.0	0.203	49.4	LOS D	4.5	31.8	0.82	0.69	33.9
Approach		220	0.0	0.203	36.5	LOS C	5.5	38.5	0.71	0.72	36.8
North: Cumberland Highway											
7	L2	34	0.0	0.216	27.9	LOS B	7.8	54.3	0.62	0.56	42.3
8	T1	809	0.0	0.356	23.7	LOS B	14.0	98.1	0.66	0.58	43.1
9	R2	26	0.0	0.105	33.7	LOS C	1.1	7.8	0.65	0.70	38.1
Approach		869	0.0	0.356	24.2	LOS B	14.0	98.1	0.66	0.58	42.9
West: Thorney Road											
10	L2	89	0.0	0.153	12.8	LOS A	2.0	13.7	0.47	0.66	48.9
11	T1	116	0.0	0.370	40.6	LOS C	9.4	65.8	0.82	0.74	35.0
12	R2	66	0.0	0.370	50.0	LOS D	9.4	65.8	0.86	0.74	33.8
Approach		271	0.0	0.370	33.8	LOS C	9.4	65.8	0.71	0.71	38.2
All Vehicles		2466	0.0	0.370	21.9	LOS B	14.0	98.1	0.60	0.56	43.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	51.5	LOS E	0.2	0.2	0.86	0.86
P2	East Full Crossing	50	24.7	LOS C	0.1	0.1	0.59	0.59
P4	West Full Crossing	50	24.7	LOS C	0.1	0.1	0.59	0.59
All Pedestrians		150	33.6	LOS D			0.68	0.68

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 02 [Maud Street / Thorney Road Existing]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maud Street											
1	L2	153	0.0	0.113	5.6	LOS A	0.0	0.0	0.00	0.42	54.8
2	T1	59	0.0	0.113	0.0	LOS A	0.0	0.0	0.00	0.42	56.3
Approach		212	0.0	0.113	4.0	NA	0.0	0.0	0.00	0.42	55.2
North: Maud Street											
8	T1	14	0.0	0.053	0.6	LOS A	0.2	1.7	0.31	0.47	54.8
9	R2	68	0.0	0.053	6.2	LOS A	0.2	1.7	0.31	0.47	53.1
Approach		82	0.0	0.053	5.2	NA	0.2	1.7	0.31	0.47	53.3
West: Thorney Road											
10	L2	171	0.0	0.110	5.7	LOS A	0.5	3.3	0.15	0.54	53.0
12	R2	86	0.0	0.081	6.3	LOS A	0.3	1.9	0.28	0.61	52.2
Approach		257	0.0	0.110	5.9	LOS A	0.5	3.3	0.19	0.56	52.8
All Vehicles		551	0.0	0.113	5.1	NA	0.5	3.3	0.14	0.50	53.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 02 [Maud Street / Thorney Road Upgrades]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maud Street											
1	L2	168	0.0	0.121	5.6	LOS A	0.0	0.0	0.00	0.43	54.7
2	T1	59	0.0	0.121	0.0	LOS A	0.0	0.0	0.00	0.43	56.2
Approach		227	0.0	0.121	4.1	NA	0.0	0.0	0.00	0.43	55.1
North: Maud Street											
8	T1	14	0.0	0.058	0.7	LOS A	0.3	1.9	0.33	0.49	54.7
9	R2	74	0.0	0.058	6.2	LOS A	0.3	1.9	0.33	0.49	53.0
Approach		88	0.0	0.058	5.3	NA	0.3	1.9	0.33	0.49	53.2
West: Thorney Road											
10	L2	171	0.0	0.110	5.7	LOS A	0.5	3.3	0.15	0.54	53.0
12	R2	86	0.0	0.082	6.3	LOS A	0.3	1.9	0.29	0.61	52.2
Approach		257	0.0	0.110	5.9	LOS A	0.5	3.3	0.19	0.57	52.8
All Vehicles		572	0.0	0.121	5.1	NA	0.5	3.3	0.14	0.50	53.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.